

ticularly the great interest now generally taken in seismological studies to the hope that these may aid in solving the problems inherent to the constitution of the interior of the globe. In the course of his remarks he said that the great improvement in self-recording instruments has enabled us to determine the trajectories of the seismic waves, to study their reflection, refraction, dispersion, and absorption; but he remarks that we shall never be able to avoid the terrible scourge of the earthquake, nor even to foretell it. Modern discoveries, however, have led us to consider the interior of the globe to be formed of a solid nucleus, with a density and rigidity greater than that of steel. This nucleus is enveloped by a rocky crust, but between this crust and the metallic nucleus lies, at a great depth, the layer of plastic matter, of high temperature, which explains volcanic phenomena and their localisation.

WE have received from the Royal Observatory of Belgium the results of recent balloon ascents made at Uccle, including those arranged for by the International Commission for Scientific Aëronautics, from July 27 to August 1. The observatory was very unfortunate during this period; the records of two ascents were wilfully destroyed, and only one ascent, that of July 30, reached a considerable altitude, 15.2 kilometres, where the temperature by M. Hergesell's metallic thermometer was $-59^{\circ}.7$ C. The minimum reading of the up trace was $-69^{\circ}.2$ C. at 13.2 kilometres. In the British Isles twenty-eight ascents were made during the above period, twelve of which were on account of the Meteorological Office. The preliminary results of the British series were communicated to the Royal Meteorological Society by Mr. C. J. P. Cave on December 16. The average height reached was 16.4 kilometres, the highest being 23 kilometres, at Pyrtton Hill, Oxfordshire. The records of all the balloons recovered, except one, showed the existence of the isothermal layer.

PROF. LARMOR pointed out several years ago in his "Æther and Matter" that the fundamental facts of optics and electrodynamics, those of aberration in particular, require us to assume that the æther does not partake to any sensible extent in the motion of matter through it. On this hypothesis there should, however, be certain modifications in the optical or electrical actions of bodies on each other according to the direction in which the æther is sweeping past them. Such effects have been sought for and not found, and the negative results led Profs. Lorentz and Fitzgerald to suggest as explanation that the bodies themselves undergo changes of shape when they move through the æther which accurately compensate these effects. More recently Prof. Einstein has shown that the "principle of relativity," according to which only relative motions of bodies with respect to each other can produce observable effects, leads to the same law of change of shape, and Prof. H. A. Bumstead, in an interesting article in the November number of the *American Journal of Science*, is disposed to accord it a position analogous to that of the second law of thermodynamics. He applies it in succession to the torsion pendulum, the gravitation pendulum, and to several problems of gravitation, and shows that it leads to a slight modification of the law of gravitation and to consequences which ought to be capable of detection astronomically.

As a supplement to *Rivista Marittima* (Rome) for November are published two papers, by Prof. Guido Cora, on geography and oceanography during the nineteenth century. In the second paper Prof. Cora gives a short, but comprehensive, review of the chief problems of oceanography from its foundation to the present time. The

papers should be valuable as guides to work accomplished in geography and oceanography during last century.

MR. C. BAKER, of High Holborn, London, has forwarded a copy of the 1909 issue of section iv. of his catalogue. The catalogue is divided into four parts, dealing respectively with aids to vision, prismatic and other optical appliances, projection apparatus, and meteorological and allied instruments. We have also received the current issue of Mr. Baker's classified quarterly list of second-hand instruments which he has on sale or hire.

OUR ASTRONOMICAL COLUMN.

SEARCH FOR AN ULTRA-NEPTUNIAN PLANET.—Following the recent interesting discussion by Prof. Forbes at the Royal Astronomical Society, of the probable existence of a planet beyond the orbit of Neptune, there is an interesting note by Prof. E. C. Pickering in No. 4292 of the *Astronomische Nachrichten* (p. 323, December 18).

In this note Prof. Pickering mentions that as the result of an investigation, an abstract of which was read at the American Academy of Arts and Sciences on November 11, Prof. W. H. Pickering finds evidence of the existence of an ultra-Neptunian planet, which at the epoch 1909.0 will be located approximately in R.A. 7h. 47m., dec. $+21^{\circ}$. Photographs of this region have already been taken with the 24-inch Bruce telescope at Arequipa, and the Rev. J. H. Metcalf is also employing his 12-inch doublet for the same research.

As this region is now easily accessible, Prof. Pickering asks that other astronomers, having the use of suitable instruments, should join in the search. Should the proposal be accepted by any number of workers, it is proposed that a systematic study of this portion of the ecliptic might be organised.

FURTHER OBSERVATIONS OF MOREHOUSE'S COMET, 1908c.—In No. 24 of the *Comptes rendus* (p. 1263, December 14) M. J. Guillaume gives some further interesting details concerning the remarkable changes which took place in the form of comet 1908c as observed at the Lyons Observatory.

On October 24 the nucleus was seen to be elongated and to have a granular appearance with a small stellar condensation, of about the thirteenth magnitude, towards the eastern extremity of the head. The light of a star, of the tenth or eleventh magnitude, appeared to be augmented as the head of the comet passed before it until it reached the eastern edge, when sudden diminutions of brightness occurred at intervals of several seconds.

Remarkable oscillations of the brightness of various parts of the coma were also observed, and on November 17, when the field of the telescope was artificially illuminated, the comet disappeared with a star of the ninth magnitude.

The same number of the *Comptes rendus* also contains the results of observations of the comet's position, made at the Toulouse Observatory between October 2 and 13.

THE FIGURE OF THE SUN.—In No. 26 of the Contributions from the Observatory of Columbia University, New York, Prof. Charles Lane Poor brings together in a general discussion the results hitherto obtained from investigations dealing with the figure of the sun, and its possible variations.

Some of the earlier results were directly contradictory in their statements as to whether the equatorial or the polar diameter was the longer, whilst later results indicate that although there may be a fluctuating difference, its magnitude is insufficient to show definitely.

Prof. Poor, summing up the general results of the present investigation of meridian, heliometer, and photographic measures, concludes that the exact shape of the sun is not known, but the generally accepted idea that it is a sphere is at least open to question. All the measures show a departure from the spherical form, but the difference between the various radii probably does not exceed $0''.25$.

The available heliometer measures indicate a fluctuation of the sun's shape corresponding with the 11.3-year sun-spot period, but probably not exceeding $0''.10$, whilst the observations of Ambronn and Schur possibly indicate another, shorter, period, of about twenty-eight days.

To determine this question, a long, homogeneous series of observations is necessary, and a photographic heliometer would probably furnish the best results. Experiments in this direction have already been made.

A REMARKABLE METEOR.—In No. 4287 of the *Astronomische Nachrichten* Prof. Kopff describes a remarkable meteor which left a persistent, drifting train for about half an hour. The meteor was first seen at 12h. 55m. (M.T. Königstuhl) at Heidelberg, and was brighter than Venus, its colour being a yellowish white. It appeared about 2° east of α Ursæ Majoris, and travelled along a path parallel to the line joining α and γ Ursæ. The luminous trail changed its shape and position, and was finally observed at 13h. 25m.

SUN-SPOTS IN 1907.—The frequency and heliographic distribution of sun-spots in 1907 are discussed by Dr. Rudolf Wolf in No. 99 of the *Astronomische Mitteilungen*. The monthly relative numbers show maxima in February and September, the daily relative number between February 9–14 exceeding 170; for the year the mean monthly number was 62.0. Some interesting tables and curves show the relations between the variations in sun-spot numbers and terrestrial magnetism.

THE PARALLAX OF 61 CYGNI.—The results of a new determination of the parallax of 61 Cygni, carried out by Prof. G. Abetti at Heidelberg 1906–8, are published in No. 9, vol. xxxvii., of the *Memorie della Società degli Spettroscopisti Italiani*. About 7000 observations were made, and their reduction, in three series, gives the following figures for the parallaxes of the components of the star:—61 Cygni pr. $\pi = +0''.24$, mean error, $\pm 0''.05$; 61 Cygni f. $\pi = +0''.22$, mean error, $\pm 0''.05$.

ADVANCE IN KNOWLEDGE OF CANCER.

IN conformity with a scheme of inquiry embarked upon in October, 1902, the third scientific report of the Imperial Cancer Research Fund, recently issued, treats, like its predecessors, of cancer as a problem of general and experimental biology. It contains no definite answer to the questions, What is the nature and what the cause of cancer? and beyond demonstrating that systematic experiment justifies the early surgical removal of a tumour as the only possible treatment at the present time, the report is silent as to remedial and preventive measures. These shortcomings will almost certainly arouse misgivings on the part of those who cannot appreciate how progress is made in any field of knowledge. They will also, no doubt, be seized upon by persons who, in their ignorance, assert that all scientific efforts should be concentrated on utilitarian ends, and they will be exploited by the charlatan, to whom for a space a free field is still left for his nostrums. The sustained efforts of the past six years to penetrate the mysteries of cancer have been accompanied by a corresponding activity on the part of faddists and quacks who advertise themselves by proclaiming the failure of scientific investigation to yield "practical fruits." The danger of their literary activity is but enhanced by the powers of diction and of exposition possessed by some of the writers. They could profitably devote their literary ability to expounding to the public the true facts and difficulties of the cancer problem instead of the ridiculous causes they maintain before a jury of the credulous and the suffering. In the absence of this enlightened attitude on their part it is my duty, since the second scientific report was followed by volumes of nonsense on the part of such persons, bluntly to inform the general reader of the folly of ignoring the necessity for the early surgical removal of cancer, and of running from one faddist or quack to another yet more ignorantly sanguine. If, in the future, the progress of scientific investigation provides a substitute for or an adjunct to surgical treatment, there will

be no needless delay in placing it within the reach of the cancer patient.

Meantime, the importance of the investigation of cancer is only too grimly emphasised by its frequency as a cause of death. The number of deaths recorded from cancer increases from year to year throughout the world, civilised and uncivilised, human and animal. Taking England and Wales as an example, in 1889, on an average, the chance of a man above thirty-five years ultimately dying of cancer was one in twenty-one, and for a woman above the same age one in twelve. The increase in the number of deaths recorded from cancer makes the corresponding chances to-day one in eleven for men and one in seven for women. Scarcely a family of large size escapes attack. There is no circle of acquaintances, no chance assemblage of persons at a *table d'hôte* or in a tube lift, but contains prospective victims. But is cancer really increasing? The accurate use of statistics, and the careful scrutiny of the scientific value of the data upon which they are based, still withhold an affirmative answer. If it be further asked, Is not cancer much more frequent in races living under European civilisation than in the rest of mankind? recent investigation has disposed of the fiction that many races of mankind are exempt. Where the disease was said to be rare, e.g. in Japan, there are excellent statistics of which Europeans were previously ignorant proving the great frequency of cancer among the Japanese, and, taking another example, investigations in Indian hospitals show that certain forms of cancer very common in London hospitals are probably not less common in hospitals throughout Hindustan. In the case of most other races there are insurmountable difficulties in the way of even thus roughly estimating its frequency among them. Therefore it is idle to affirm or to deny that cancer may be more common in some races than in others. The disease occurs throughout the human race, and its association with forms of chronic irritation having nothing in common beyond this association is a fact of more moment than any futile discussion of the relative liability of different races. The additions, during six years, to our knowledge of its occurrence in man, as well as in tame and wild animals, tell hard against those who, at the close of the nineteenth century, argued that the increase in the number of deaths attributed to cancer was real, and merely a penalty for living under the influences of European civilisation.

Much additional evidence has been obtained of the extent to which cancer pervades the vertebrate scale. The similarity of the disease throughout vertebrates is illustrated most diagrammatically by a series of preparations of skin-cancers from mammals to marine fish living in a state of nature. Wherever data are available, for animals as for man, the liability to cancer is shown to be greatest in the last third of the span of life, whether it be short or long; the "age-incidence" of cancer in man has acquired enhanced significance by the establishment of this generalisation.

The widening of our knowledge of the occurrence of cancer is only one example of how revived interest in mere observation has put an end to the era of unverified, and often unverifiable, speculation which characterised the last twenty years of the nineteenth century, when exact methods of studying the clinical course, the anatomy, and the microscopical structure of tumours had reached their natural limitations. The study of cancer solely from the standpoint of its being an infective disease had yielded equivocal and self-contradictory results. Statistical methods had become barren from want of data to work on. No point vulnerable to an attack in the rear by the experimental method could be discerned.¹ In short, there was a standstill in the advance of knowledge. As is usual in all similar epochs in the progress of science, observation, hypothesis, and experiment had ceased to advance hand in hand. The arm-chair speculator had the field to himself. With only the knowledge derived from the bedside, the study of the structure of tumours in man, imper-

¹ As a matter of fact, such a point of attack had existed since the time when Hanau and Morau had successfully inoculated cancer from one animal to another, but those engaged in cancer research had either failed to realise the significance of this important work or had been baffled by the difficulties which had to be overcome in attempting to imitate it.